

## Using Extracts of Coconut Palm Leaves and Shoots as Lure for Rhinoceros Beetles: A Preliminary Study

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### Abstract

Coconut palm pest infestation is a major problem for farmers. The rhinoceros beetle is a common pest. Severe infestations of rhinoceros beetles can even result in coconut trees dying. Synthetic rhinoceros beetle pheromones, used to lure rhinoceros beetles into traps, are commercially available but are expensive. Here the possibility of deriving extracts from parts of the coconut palm to use as lures to replace the commercially available lure was studied. Extracts were derived from the leaves and the young shoot of the coconut palm and tested for their ability to lure rhinoceros beetles, with the commercially available lure used as a control in the tests. It was found that extracts from coconut shoot were effective in attracting rhinoceros beetles at a level similar to synthetic rhinoceros beetle pheromones. The use of extracts from coconut shoot in place of commercially available synthetic rhinoceros beetle pheromones is therefore recommended as a low-cost and environmentally friendly alternative for coconut farmers.

**Keywords:** *rhinoceros beetle, lure, coconut shoot extract, synthetic pheromones*

### 1. INTRODUCTION

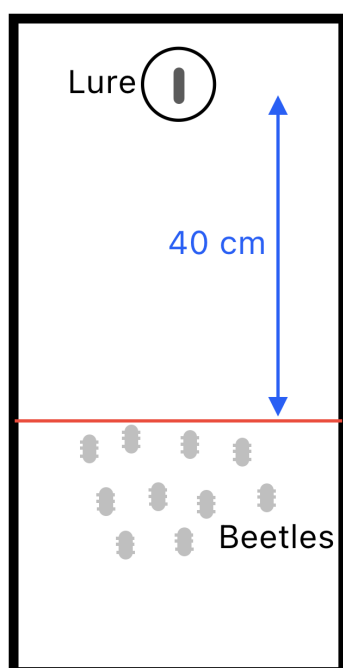
Coconuts are an important cash crop in Thailand, and have always been important in the life and culture of the Thai people. Coconuts are an important factor in Thai cuisine. Uncontrolled coconut pest outbreaks have resulted in the land area under coconut cultivation being reduced and converted to other crops such as sugar cane and rubber. The longevity of coconut palms makes controlling pest populations more difficult, and results in the area of pest infestations increasing. The resulting damage to coconut plantations has resulted in a decline in coconut yields to a point where coconut production is insufficient to meet demand. (Thai PBS, 2012).

Rhinoceros beetle (*Oryctes rhinoceros*) infestation is a common problem for coconut farmers. Rhinoceros beetles damage coconut trees by boring into the heart of the crown, causing the coconut tree to eventually die. Research has shown that male rhinoceros beetles produce a mix of pheromones (aggregated pheromones) which attract both male and female beetles. The Pheromone ethyl 4-methyloctanoate (E4MO) can be used as a control

agent for rhinoceros beetles using mass trapping to control beetle populations, with the ratio of attracted male to female beetles being 1 to 3. (Purba, 2000)

Synthetic E4MO is a volatile liquid substance. It is typically sold in a bulb that can be slowly evaporated and released. The E4MO bulb will typically last approximately 12 weeks after the installation of the trap, depending on the temperature of the area. A study of trapping in Malaysia showed that 56 - 70 % of the rhinoceros beetles trapped are female, and that trapping can reduce the population of female rhinoceros beetles, especially when pregnant female rhinoceros beetles are trapped. ( Phiphat, 2007 )

Commercially available synthetic rhinoceros beetle pheromone is quite expensive, and is a significant cost for farmers when trying to prevent rhinoceros beetle infestations through trapping. The potential for using extracts from the coconut palm to replace the synthetic pheromone in trapping was therefore investigated, as a way of reducing farmer costs while still allowing them to control rhinoceros beetle infestations in coconut plantations.



**Figure 1.** Initial setup of the testing fields, with the lure at one end and the 10 beetles placed at least 40 cm away.

## 2. METHODS

### Preparation of the extract from leaves and young coconut shoots

Coconut leaves and young coconut shoot (heart of coconut) were kept at 40 °C for 24 hours to dry, and then thoroughly ground into a powder. A sample of 100 g of the coconut leaf powder was stirred into 500 ml of hexane, then covered and left for 24 hours. The same was done with the coconut shoot powder. After 24 hours, the mixture was filtered with a cloth, and then evaporated in a vacuum evaporator until only a viscous extract remained. The resulting extracts of coconut leaf and coconut shoot was stored at 4 °C.

### Testing Extract Luring Effectiveness

Three experimental fields, 40 x 80 cm, were made using plastic sheets. Leaf extract, shoot extract, and synthetic pheromone were placed in a small dish approximately 10 cm from one end of each of the fields, and 10 rhinoceros beetles were placed a minimum of 40 cm from the dish, as shown in Figure 1. Fifteen minutes after the beetles were placed, the number of beetles that had moved to less than 40 cm from the lure were counted. The test was repeated three times.



**Figure 2.** The beetles after 15 minutes, with 5 beetles within 40 cm of the shoot extract lure (trial 1).

## 3. RESULTS AND DISCUSSION

As can be seen in Figure 2, five beetles moved closer to the shoot extract in trial 1 (left) while only three beetles moved closer to the leaf extract in trial 2 (right). The results of the rhinoceros beetle lure test data, shown as percentages, are shown in Table 1. The mean values of rhinoceros beetles lured with synthetic pheromones was 66.7 with leaf extract being 23.3. Statistical analysis showed that the correlation between the rhinoceros beetle lure rate for synthetic pheromone and leaf extract has a p-value of 0.04, from which it can be concluded that coconut leaf extract was significantly (at the  $p=0.05$  level) less effective at luring rhinoceros beetles than

Trial	Percentage of the Beetles Approaching the Lures (%)		
	Coconut Leaf Extract	Coconut Shoot Extract	Synthetic Pheromone
1	20	50	60
2	30	70	60
3	20	70	80
<b>Mean</b>	<b>23.3</b>	<b>63.3</b>	<b>66.7</b>

**Table 1.** The results of the lure tests

synthetic pheromones. Comparing the shoot extract to synthetic pheromone, it was found that the p-value is 0.67, indicating that shoot extract was equally effective (at the  $p=0.05$  level) at attracting rhinoceros beetles. Finally, it is clear that the shoot extract is more effective than leaf extract in its ability to attract rhinoceros beetles.

We acknowledge that the few trials done here reduce the level of confidence in the results. More extended testing must be conducted before it can be recommended with confidence that farmers may use coconut shoot extract instead of purchased synthetic pheromone for controlling rhinoceros beetle infestations, as a way of reducing cost and environmental impacts. More testing is needed to determine the efficacy and durability of coconut shoot extract in lure of rhinoceros beetles of both genders. Extensive field tests in coconut plantations using traps must also be done. Further testing on the effectiveness of extracts from other parts of the coconut palm, such as coconut meat or shells, might also be useful.

#### 4. CONCLUSION

It was shown that coconut shoot extract is likely effective as a substitute for commercially available synthetic pheromone for use as rhinoceros beetle bait for coconut tree pest protection, as it was as effective as the pheromone in luring beetles. The extract from coconut leaf was shown to be ineffective as a lure for the beetles, with lure rates

much lower than for either shoot extract or synthetic pheromone.

#### 5. REFERENCES

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